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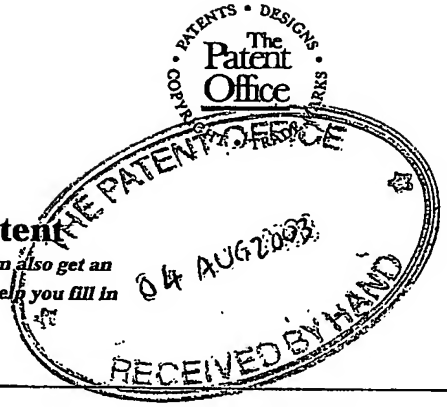

1/77

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P01/7700 0.00-0318227.6

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Cardiff Road
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1. Your reference — AWP/P63032/000

2. Patent application number *(The Patent Office will fill in this part)* — 0318227.6 — 4 AUG 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

ADCOCK TECHNOLOGY LIMITED
17 GELDERS HALL ROAD
SHEPSHED,LOUGHBOROUGH
LEICESTERSHIRE LE12 9NH
UNITED KINGDOM

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — UNITED KINGDOM

7687825001

4. Title of the invention — A TAP AND A METHOD OF TAPPING

5. Name of your agent *(if you have one)* — BOULT WADE TENNANT

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

VERULAM GARDENS
70 GRAY'S INN ROAD
LONDON
WC1X 8BT

Patents ADP number *(if you know it)* — 42001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

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b) there is an inventor who is not named as an applicant, or
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Description	6
Claim(s)	4
Abstract	-
Drawing(s)	2 + 2

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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
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Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 4/8/03

12. Name and daytime telephone number of person to contact in the United Kingdom: MR. A.W. PLUCKROSE - 0207 430 7500

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A TAP AND A METHOD OF TAPPING

The present invention relates to a tap and to a method of tapping.

In particular the present invention relates to a tap designed to cut a female translational screw-thread in metal, ie. the type of screw-thread designed to impart longitudinal motion to a rod with a matched male thread on the exterior thereof on relative rotational motion therebetween. Typically, in the past such taps have had a thread trapezoidal in form since it has been accepted that this is best practice for a thread designed to impart translational motion. However, the taps necessary to create trapezoidal female screw-threads are typically expensive, wear quickly and have a long cycle time compared to a tap according to the present invention. In part this is due to the fact that the trapezoidal taps are of necessity fluted, because of the amount of material that needs to be moved to form a female trapezoidal screw-thread.

The present invention provides in a first aspect a tap for the formation in a first member of a female screw-thread of a type suitable to impart translational motion to a second member with a matching male screw-thread on relative motion between the first and second members, the tap being fluteless and comprising a threaded portion with a triangular form thread with an angle of thread in the range 29°-40° and radiussed crests.

The tap of the present invention costs less to

manufacture, is more wear-resistant and has a shorter cycle time than the trapezoidal types of the prior art. In trials a trapezoidal tap lasted for the creation of 500 parts whilst the tap of the present invention lasted 740 parts. The cycle time of the trapezoidal tap was 26 seconds, compared with a 4.5 second cycle time of the tap of the present invention.

The present invention in a second aspect provides a product having a tapped bore with a female screw-thread formed using the tap described above.

The present invention in a third aspect provides a method of tapping a product in which a female screw-thread is formed using a tap as described above.

The present provides in a fourth aspect a method of manufacture and use of apparatus which has a first metal object with a female screw-thread and a second metal object with a matching male screw-thread, the method comprising the steps of:

forming in the first metal object a female screw-thread using a tap as described above;

forming on at least a part of the second metal object a male screw-thread matching the female screw-thread of the first metal object;

engaging the male screw-thread of the second metal object with the female screw-thread of the first metal object; and

rotating one of the first and second metal objects relative to the other in order to occasion translational motion of the second metal object relative to the first metal object.

In the prior art there has also been encountered

a technical problem of setting in place a threaded rod between two brackets with the brackets having female screw-thread receiving the male thread of the threaded rod and with the brackets accurately spaced.

The present invention provides in a third aspect a method of securing a threaded rod to a pair of spaced apart brackets comprising the steps of:

forming female screw-threads in each of the pair of spaced apart brackets, the thread of each of the female screw-threads matching the external thread on the threaded rod;

during forming the female screw threads in the brackets setting a chosen orientational relationship between the female screw-threads of the pair of brackets;

securing the brackets one each to the ends of the threaded rod by engagement of the external thread of the threaded rod with the female screw-threads of the brackets and by relative rotation between the rod and the brackets; and

setting a spacing between the brackets by occasioning a chosen number of complete relative rotations between each bracket and the threaded rod as the brackets are rotated on to the ends of the threaded rod.

A preferred embodiment of tap according to the present invention will now be described along with examples of preferred methods of using the tap, all with reference to the accompanying drawings in which:

Figure 1 is a cross-section through a tap according to the present invention, taken axially along the tap;

Figure 2 is a first transverse cross-section

through the tap of Figure 1;

Figure 3 is a second transverse cross-section through the top of Figure 1;

Figure 4 is a side view of the tap of Figures 1 to 3;and

Figure 5 is a cross-sectional view of an arrangement of threaded rod and gearbox, the threaded rod being secured by threaded brackets with female screw-threads formed by a tap of the present invention.

Figure 1 shows a cross-section through a front section of a tap 10 according to the present invention. The tap 10 is fluteless, although it may have one or more lubrication grooves. The tap 10 has a thread 11 which is triangular in form. The angle α of the thread 11 is 30° (i.e. a half-angle of 15°) and the thread has a pitch of 1mm with a tolerance of 0.005 mm. The tap 10 has a chamfer of four threads 12-15 with a chamfer angle β of 6°. The tap 10 has crests 16 which are each rounded with a radius (when viewed in an axially extending cross-section - Figure 1) of 0.169 mm. The roots 17 are each rounded with a radius (when viewed in an axially extending cross-section - Figure 1) of 0.83mm. The roots 17 are separated by 36° (plus or minus 1°) when viewed in a transverse cross-section as in Figure 3; there are five lands 18-22. As seen in Figure 4, the tap 10 has a threaded portion 23, a shank portion 24 and a square cross-section portion 25 to be engaged by a chuck. The distance between the end 25A of the square section 25 and the beginning of the threads on the threaded portion 23 is defined to a close tolerance.

The tap 10 is provided with two starts so that there are two helical grooves running along the

threaded portion 23. The threaded portion 32 at least has a titanium nitride coating.

When the tap 10 is used to form a female screw-thread the thread is flow formed rather than cut (as is the case with the fluted trapezoidal thread taps usually used). This gives a very good surface finish to the formed thread and good conformity to the thread defined on the tap. This is crucial for good meshing efficiency.

Above the angle of thread is given as 30° (15° half angle) and this is preferred because it is ideal for the generation of translational motion when interacting with a matched male thread. However, angles in the range of 29°-40° (14.5°-20° half angles) would also work well. The radius of each root 17 will be determined as a proportion of thread depth. In the identified example the root radius 0.83mm is approximately 20% of the thread depth of 0.924mm. The percentage must be sufficient to allow for material flow into the thread without the material completely filling the thread. Whilst above the tap 10 has two start points and two co-extending helical threads, it may in some circumstances be preferred to have three start points and three co-extending helical threads. Whilst above the roots 17 are shown as rounded, this is not essential and they could be e.g. flat-bottomed.

The tap 10 can be used to form an internal thread of a rotating nut 100 of a gearbox 101 used in sliding rail mechanisms for a car seat. The gearbox 101 is secured to a rail 102. A threaded rod 103 is fixedly secured to a pair of brackets 104 and 105, each of which also has an internal screw thread formed by use

of the tap 10. It is important that the distance between the brackets 104 and 105 is set accurately and so the applicant proposes tapping the brackets in a method in which so hat the helical thread in one is orientated with respect to the helical thread in the other in a chosen relationship. Thus when the threaded rod 103 is secured to the brackets 104 and 105 all that needs to be done to ensure a correct spacing of the brackets is the rotation of the brackets on the rod (or vice versa) a set number of times.

CLAIMS

1. A tap for the formation in a first member of a female screw-thread of a type suitable to impart translational motion to a second member with a matching male screw-thread on relative motion between the first and second members, the tap being fluteless and comprising a threaded portion with a triangular form thread with an angle of thread in the range 29°-40° and radiussed crests.

2. A tap as claimed in claim 1 wherein the angle of thread is 29°to 31°.

3. A tap as claimed in claim 2 wherein the angle of thread is 30°.

4. A tap as claimed in any one of the preceding claims wherein the tap has a chamfered first end.

5. A tap as claimed in claim 4 wherein the chamfered front end extends over at least four turns of the thread.

6. A tap as claimed in claims 4 or 5 wherein the chamfered front end has a chamfer angle in the range 5.5° to 6.5°.

7. A tap as claimed in any one of claims 1 to 6 which has at least two starts.

8. A tap as claimed in any one of the preceding claims wherein the radiussed crests have a radius of curvature in the range of 0.165 to 0.175 mm.

9. A tap as claimed in any one of the preceding claims wherein the roots of the threaded portion of the tap are radiussed.

10. A tap as claimed in claim 9 when the radiussed roots have a radius of curvature in the range 0.178 mm to 0.188 mm.

11. A tap as claimed in any one of the preceding claims wherein the thread has a pitch of 0.995 mm to 1.005 mm.

12. A tap as claimed in any one of the preceding claims comprising additionally lubrication grooves.

13. A tap as claimed in any one of the preceding claims comprising a shank portion extending rearwardly from the threaded portion and a rearmost portion with a plurality of flat surfaces to enable engagement of the tap by a chuck.

14. A tap as claimed in claim 13 in which at least one of the flat surfaces is precision machined in order to precisely set a distance between the front of the tap and at least one end of the flat surface.

15. A product having a tapped bore with a female screw-thread formed using the tap claimed in any one of the preceding claims.

16. A method of tapping a product in which a female screw thread is formed using a tap as claimed in any one of claims 1 to 14.

17. A method of manufacture and use of apparatus

which has a first metal object with a female screw-thread and a second metal object with a matching male screw-thread, the method comprising the steps of:

forming in the first metal object a female screw-thread using a tap as claimed in any one of claims1 to 14;

forming on at least a part of the second metal object a male screw-thread matching the female screw-thread of the first metal object;

engaging the male screw-thread of the second metal object with the female screw-thread of the first metal object; and

rotating one of the first and second metal objects relative to the other in order to occasion translational motion of the second metal object relative to the first metal object.

18. A method of securing a threaded rod to a pair of spaced apart brackets comprising the steps of:

forming female screw-threads in each of the pair of spaced apart brackets, the thread of each of the female screw-threads matching the external thread on the threaded rod;

during forming the female screw threads in the brackets setting a chosen orientational relationship between the female screw-threads of the pair of brackets;

securing the brackets one each to the ends of the threaded rod by engagement of the external thread of the threaded rod with the female screw-threads of the brackets and by relative rotation between the rod and the brackets; and

setting a spacing between the brackets by occasioning a chosen number of complete relative rotations between each bracket and the threaded rod as the brackets are rotated on to the ends of the threaded rod.

19. A method as claimed in claim 18 wherein the tapping of the female screw-threads in the brackets is performed using a tap as claimed in any one of claims 1 to 14.

20. A tap substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

: 456812: AWP: CTF: 16 April 2003

FIG. 1.

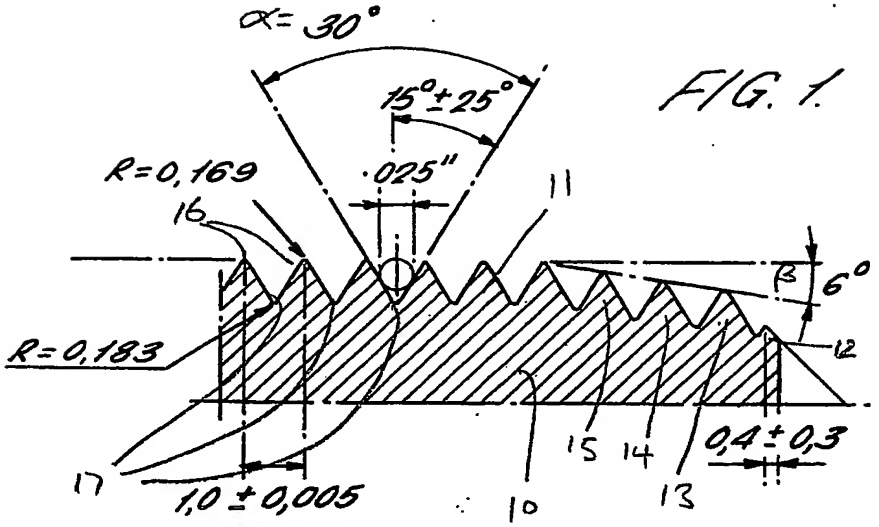


FIG. 2.

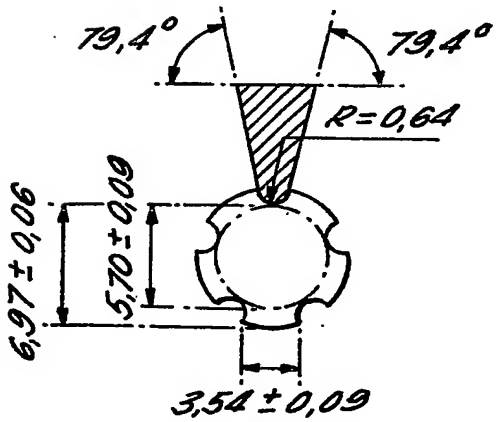


FIG. 3.

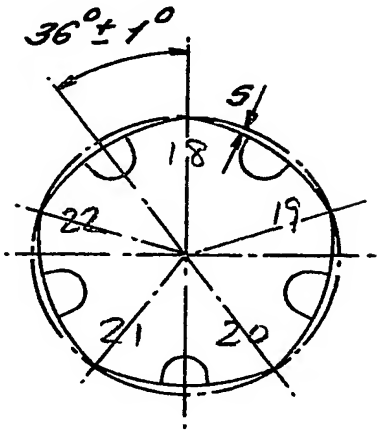
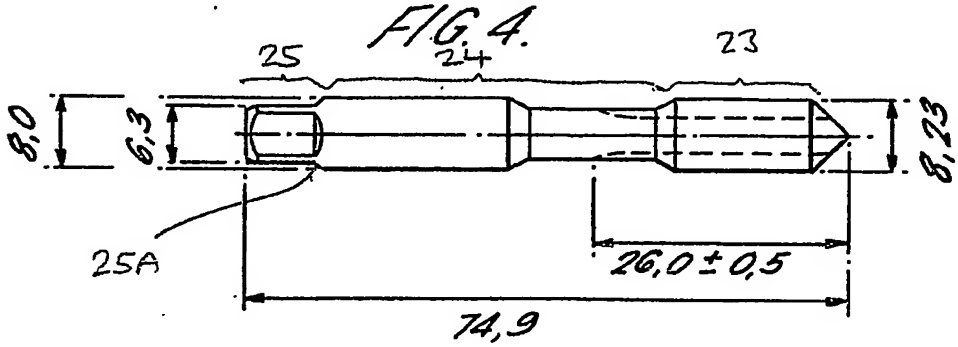


FIG. 4.



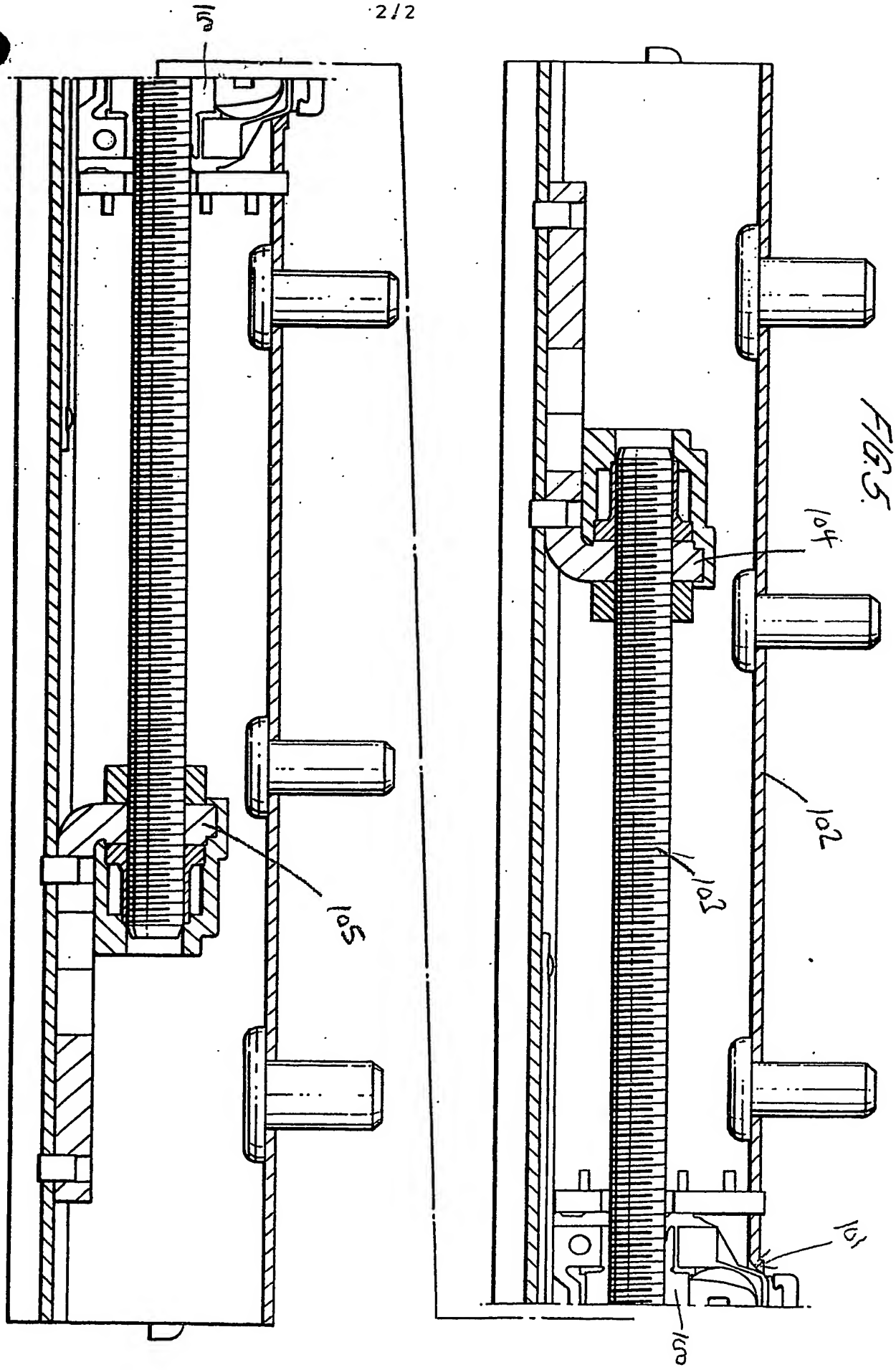


FIG. 5.